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Fair Value: Model Proposal for the Dairy Sector

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I. INTRODUCTION

In 2002, the European Commission released Regulation (EC) 1606/2002 requiring the adoption of International Accounting Standards/International Financial Reporting Standards (IAS/IFRS) by all companies with securities traded in a European stock exchange regulated market, in the preparation of their consolidated accounts. The same regulation did also allow member states to extend this requirement to other companies. Based on this permission, in July 2009 the Portuguese Accounting Committee (CNC – Comissão de Normalização Contabilística) approved a new accounting frame of reference entitled Portuguese Accounting Standardization System (SNC – Sistema de Normalização Contabilística). Consistent with Regulation (EC) 1606/2002, the SNC's accounting standards were based on IAS/IFRS, which superseded the previous Portuguese Accounting Plan (POC – Plano Oficial de Contabilidade), and were first adopted by Portuguese unlisted companies in January 2010.

The SNC's accounting standard that deals with agriculture is Accounting and Financial Reporting Standard (NCRF – Norma Contabilística de Relato Financeiro) 17 (*Agriculture*). At an international level, there are some studies that have analyzed the impact of the adoption of IAS 41 (*Agriculture*) in different countries (Elad & Herbron, 2011; Fisher et al., 2010; PriceWaterhouseCoopers, 2009, 2011). Moreover, these international studies focused on the impact of the new valuation criteria required by IAS 41: fair value. However, there are no research studies on the impact of the adoption of IAS/IFRS adapted standards by unlisted companies in specific countries. In Portugal, only one study has focused on the analysis of the factors influencing the preparedness of Portuguese unlisted companies to adopt SNC (Guerreiro et al., 2012). The present study seeks to overcome this research gap through the analysis of the adoption of NCRF 17 (*Agriculture*) by the Portuguese dairy sector.

The dairy sector is crucial to worldwide economy, achieving a current status of one of the most competitive food industries worldwide. The present study focuses on Portuguese dairy farms for three main reasons. First, the European Union is the biggest producer and exporter of milk, followed by United States of America, New Zealand, and Ukraine (CLAL, 2012). Second, production efficiency studies have concluded that countries in Western Europe (such as Portugal) and Australia have on average higher levels of technological efficiency compared to other countries such as North America, Eastern Europe, Asia, Africa, and Latin America (Bravo Ureta et al., 2007). Third, among the European Union the milk production from Poland, Italy,

Netherland, UK, France and Germany represented 72% of total production in 2011. However, Portugal continues to present the highest value of milk production (kg) per cow (7,221 kg/cow) compared to European Union mean values (6,692 kg/cow) (Eurostat, 2014a). Moreover, in Portugal this sector represented in 2011 around 11% of the total agro-food industry (IACA, 2011).

The contribution of the present study is twofold. Based on semi-structured interviews to Chartered Accountants of different dairy farms, a multiple case study was conducted to assess the level of comparability of the valuation criteria for biological assets (i.e. dairy herds) used by Portuguese dairy farms, after two years of the first adoption of SNC in 2010. The measurement criteria proposed in NCRF 17 (Agriculture) is: fair value less estimated cost to sell. However, the accounting standard indicates different ways to assess fair value. Thus some research questions will be analyzed: do dairy farms measure their dairy herds the same way they used to? What implications do animal measurement has in dairy farms net income variation? Will farms' financial information be comparable after the application of fair value criteria?

The accounting standard NCRF 17 (Agriculture) suggests that in case there is no market price for a specific type of biological assets, valuation should be made based on the present value of expected net cash-flows from the asset, discounted at a current market-determined rate before taxes. Therefore, the present study presents an innovative valuation model to assess the fair value of animals in the dairy sector and tries to assess if this new valuation criteria will represent the dairy sector's true value of the animals.

Main findings indicate that market values for dairy production animals are inconsistent, reducing financial information comparability levels. To solve these problems, a new model to assess fair value based on the net value of the future cash-flows is proposed. This is a possible method to measure bovines that are in a breeding stage assuring the comparability of financial statements among dairy farms.

In the following section, we contextualize the different accounting policies in terms of measurement criteria in agriculture proposed by different accounting frames of reference and review previous literature. Thereafter, we explain our research method, report results, and present conclusions.

II. AGRICULTURE AND THE ACCOUNTING MEASUREMENT CRITERIA

In SNC issues related to agriculture are dealt with by NCRF 17 (Agriculture). The SNC's accounting standards are based on IAS/IFRS, and therefore the recognition and measurement criteria followed by NCRF 17 are quite similar to IAS 41 (Agriculture). However, these new accounting policies are significantly different from those followed by POC, the previous Portuguese accounting frame of reference. Table 1 presents the main recognition and measurement criteria related to biological assets demanded by POC, SNC. For an international discussion on the topic Table 1 also includes the accounting policies proposed by the regulatory entities of those countries considered the main players in the dairy sector: FASB (Financial Accounting Standards Board) in the United States of America, by AcSB (Accounting Standards Board) in Canada, by NZASB (New Zealand Accounting Standards Board) in New Zealand, by AASB (Australian Accounting Standards Board) in Australia, and by FRSC (Financial Reporting Standards Council) in South Africa.

(Insert Table 1 here)

A biological asset is a living animal or plant, such as dairy cattle. Biological assets are different from agricultural produce, which is the harvested product of the entity's biological assets, such as milk from dairy cattle.

From an international perspective, Table 1 shows that those countries considered the most important players in the dairy sector apply the accounting recognition/measurement criteria proposed by IASB. The only exception is the United States of America. The FASB has specific recognition/measurement criteria for biological assets, which are quite similar to those proposed in the previous Portuguese accounting frame of reference.

The accounting recognition/measurement criteria followed by the previous POC is very different from the one established in SNC. In POC biological assets were considered fixed assets measured at cost less any accumulated depreciation. In SNC, the NCRF 17 requires that all biological assets shall be measured at fair value less costs to sell. However, there is an opt-out clause that suggests that biological assets can be measured at cost less any accumulated depreciation and any accumulated impairment losses if fair value cannot be measured reliably. This opt-out clause can only be applied in the initial recognition of biological assets.

Elad and Hebron (2011) findings indicate that some countries did not use the opt-out clause, but others did. This undermines the comparability of financial information.

Moreover, IAS 41 and NCRF 17 express different ways to assess fair value. If an active market exists for a biological asset, the quoted price in that market is an appropriate basis for measurement. The NCRF 17 states that the quoted prices published in the Portuguese Information System on Agro-Food Markets (SIMA [1] – Sistema de Informação de Mercados Agrícolas) can be used to assess fair value.

If an active market does not exist, fair value can be assessed by: a) the most recent market transaction price; b) market prices for similar assets with adjustments to reflect differences; c) sector benchmarks; and d) present value of expected net cash flows from the assets discounted at a current market-determined rate before taxes. These different alternatives induce subjectivity in estimates of fair values undermining comparability and reliability of financial information and providing scope for manipulation (Herbohn, 2006).

III. LITERATURE REVIEW

In terms of IAS/IFRS adoption, one of the most debated topics concerns the relevance of fair value adoption compared to historical cost. In this sense, Barlev and Haddad (2003) contend that financial reporting prepared under this new paradigm would be more value relevant, and call the attention of shareholders to the value of their equity and enhance the function of stewardship. Other studies have concluded also that among banks the adoption of fair criteria is associated with smaller profits volatility, mainly due to standard flexibility (Fietcher, 2011).

Among all IAS/IFRS, the accounting standard more deeply influenced by this new valuation paradigm (fair value valuation criteria) was IAS 41 (*Agriculture*). On this regard, Aryanto (2011) concluded that the impact of IAS 41 (*Agriculture*) adoption was not as positive as expected, creating a substantial volatility in investment returns and influencing decision-making processes, therefore distorting companies' financial comparability levels.

Similarly, Elad and Herbohn (2011) analyzed the application of fair value in the agricultural sector due to IAS 41 (*Agriculture*) enforcement, through the analysis of annual reports of small and medium agriculture companies from United Kingdom, France and Australia. Findings show the use of a variety of valuation criteria under IAS 41 in the three countries, leading to a lack of comparability of financial statements. In companies' opinion, fair value recognition costs outweigh its benefits, concluding that

the impact of IAS 41 adoption was extremely reduced. As a result, authors argue that IASB should revisit IAS 41.

In New Zealand, Fisher *et al* (2010) findings corroborate this argument, indicating that the flexibility of IAS 41 allows for measurements at historical cost, originating discrepancies in companies' earnings.

Silva et al (2012) concluded that fair value adoption by Brazilian companies to measure biological assets turns decision making processes more difficult. Historical cost was considered more reliable, more objective and easier to perceive.

However, some studies have concluded the opposite (Azevedo, 2005; Fernandes, 2009; Argilés et al., 2011; Argilés et al., 2012). Azevedo (2005) and Fernandes (2009) conducted studies to assess the impact of IAS 41 in Portugal and concluded that the adoption of fair value valuation criteria was positive, representing a more adequate valuation model than historical cost model, and inducing a rise in companies' earnings.

Among Spanish farms, Argilés et al. (2011) did not find any significant differences between the valuation of biological assets at historical cost and fair value in assessing future cash flows. However, results show more predictive power of future earnings under fair value model. They also found several flaws in the historical cost accounting practices adopted by Spanish farms.

By conducting interviews with students, farmers and accountants of Spanish farms Argilés et al. (2012) found that the interviewees make larger miscalculations and make poorer judgments under historical cost model than under fair value model. Fair value model is friendlier than historical model, in terms of financial statements preparation and enhance judgment in decision-making processes.

The present paper does not intend to contribute to the discussion on the topic of fair value model versus historical cost model. After the analysis of the accounting standard NCRF 17 (Agriculture), the different ways to assess fair value included in the standard, and the existence of an opt-out clause, leads to question the comparability of financial information. The present study focuses on the analysis of the different valuation criteria for biological assets in Portuguese dairy farms, and discusses potential solutions to improve future comparability of financial information in the dairy sector.

IV. RESEARCH METHOD

SAMPLE

To attain an extensive understanding of the Portuguese dairy sector reality, the central region of Portugal was selected. According to Eurostat (2014a) this region is the most important in terms of milk production (267,165 tones), number of dairy farms (6,974), and cows (37,000). The central region of Portugal comprises several districts. In the present study it was selected the most important district of the central region of Portugal, the district of Aveiro. This district has a huge density of dairy farms (870 farms) and represents the main Portuguese region in terms of milk production. The choice of a specific region and district was made in order to be able to develop the simulation tests to assess the comparability of the different valuation criteria for biological assets used in the several dairy farms, including the quoted market prices published in SIMA. SIMA quoted market prices are presented by regions. Therefore, to exclude any potential bias derived from regions asymmetries, we focused the present study in only one region.

The methodology used includes three steps. First, we conducted semi-structured interviews, by telephone, to Chartered Accountants of all dairy farms from the district of Aveiro. From the 870 dairy farms only seven Chartered Accountants have expressed their will to collaborate with us and voluntarily provided all the information we needed, such as: financial statements from the year 2011, the quoted market prices used at end of the reporting period to value the different types of animals in the dairy farm, and the animal's age classification bands. We also requested some production information, such as contribution of feeding costs, daily female calves feeding cost, daily heifer calves feeding cost, and lactation production. Only one dairy farm provided this kind of information.

With data collected at this stage we obtained seven different animal's age classification bands with different quoted market prices. Since NCRF 17 establishes that Portuguese companies can assess fair values through the use of quoted market prices from SIMA platform, we also considered SIMA's classification bands and quoted market prices[2]. The analysis of the results culminated in a matrix of eleven animal's age classification bands X eight valuation methods (Appendix 1).

To homogenize the analysis at stage two we compared the eight different animal's age classification bands and built one single animal's age classification band. Then, from the seven financial statements of seven dairy farms we selected four dairy farms that

have adopted SNC: two dairy farms with the highest level of positive net income and two dairy farms with the highest level of negative net income. A multiple case study to analyze the differences among the different prices was then conducted and the financial statements where submitted to several simulations to find out the impact of the different valuation criteria (variation in the quoted market prices used and collected previously in the interviews) on net income. The selection criteria used was useful to create homogeneity in the analysis. For confidentiality purposes, those dairy farms will be named Company A, Company B, Company C, and Company D, respectively.

In a third stage an innovative valuation model to assess the fair value of animals in the dairy sector is presented which tries to assess the dairy sector's true value of the animals.

V. RESULTS OF THE CASE STUDY

SIMULATION FINDINGS

When observing the information collected from interviews (Appendix 1), it was noticed that, despite the use of market value by all accountants obtained from animal traders and SIMA, there was a great disparity in herd measurement. The animal's age classification bands are completely different and prices too. If accountants use these data to measure the value of animals at the end of each reporting period, this disparity would undermine the comparability of financial information across the sector.

In order to better perceive the differences, we simulated 8 distinct systematic ways of measuring animals in the four dairy farms (table 2). Only simulation 8 corresponds to SIMA measurement criteria.

(Insert Table 2 here)

Table 2 shows that, in the four companies, simulation 3 and 4 generate an increase in the total amount of animals when compared to simulation 1. The remaining simulations present lower values. Results are consistent among companies.

Table 3 shows that the huge disparity obtained in biological assets measurement causes substantial variation in companies' net income.

(Insert Table 3 here)

The range of results reflects the evident distortion in the recognition of dairy herds. In Table 3 we can see that in Company A we can obtain a maximum of positive net income of 52,774€ or a maximum of negative net income of 58,101€. The difference reaches 110,875€, obviously with a great impact on farm decision-making processes. We can conclude that there is no comparability of financial information among dairy farms, despite the fact that all farms use market value.

It is fundamental that the market, and especially SIMA, should issue a more rigorous and accurate measurement. Only with consistent data can we obtain the real measure of dairy farms and compare it reliably. Accounting procedures should then contribute to a correct decision-making process on the part of stakeholders. If based on inconsistent information, even when that information in available in the market, accounting procedures cannot be useful to decision-making processes.

Due to this huge disparity either in animal's age classification bands or quoted market prices, and knowing that NCRF 17 (Agriculture) establishes that fair value can also be assessed by the present value of expected net cash flows from the assets discounted at a current market-determined rate before taxes, we believe that this methodology to assess fair value would lead to objective values at the end of each reporting period, consistent with production and animals characteristics, and consequently would allow an improvement in the comparability and reliability of financial information across dairy sector.

FAIR VALUE CALCULATION FORMULA

After analyzing the application of fair value in the dairy sector, and given the inconsistency of the recognized current amounts, we will propose a model which allows us to obtain the measure of Holstein Friesian milk-producing animals based on the future economic benefits they will bring to the farm.

When we talk about dairy herd fair value, two aspects should be taken into account: the production curve and the remaining variables which influence the price of the animal. In fact, its market value is measured against the number of milk litters it produces. Therefore, to better measure an animal, it is necessary to know which future economic benefits it will bring, and proceed with the computation of the present value of these future cash flows. For that purpose, and for each period of animal life, we should contemplate the following variables: milk price, average production, timely production,

feeding costs, and a representative variable of exceptional factors, either positive or negative. We would then obtain the following formula to measure the value of an animal in the *t* period:

$$VA_t = (nu * adp * mp) - \big(fcc * (nu * adp * mp)\big) + ef$$

for *t* in which

$$adp = 0 \ => \ VA_t = fc$$

being,

va_t- value of an animal in the *t* period
nu - number of useful working days in production
adp –average daily production for *t* period
mp - milk price for *t* period
fcc – feeding costs contribution
fc – feeding costs
ef – exceptional factor

Since to calculate the fair value we need to calculate the present value of the future economic benefits the animal will generate during his useful life in the farm, there is a need to calculate the benefit for each year, subtracting costs against the revenues the animal will generate and discounting the value derived thereof by applying the return rate. All updated benefits are added in order to obtain the present net value of the animal. Feeding is the highest cost of dairy farms and it is proportional to milk production; as a result, we considered the value of costs as a percentage of revenues.

Therefore, making use of the updated net cash flows, we obtain:

$$PNVA = \sum_{t=1}^{n-1} \left[\frac{va_t}{(1+i)^t}\right] + \left[\frac{va_n + sp_n}{(1+i)^n}\right]$$

Being,

pnva – present net value of the animal
va_t – value of an animal in the *t* period
i – return rate
n – number of years of animal's useful life
sp_n – animal selling price for *n* period

To implement this formula, it is essential to understand the production curve of dairy herds. As this calculation has individual application, it is crucial to locate the animal in the milk production curve and proceed from then on with the calculation of its measure.

It should be taken into account that the number of years of the animal's useful life refers to the time the animal finds itself in the farm which is being subject to analysis and not to the total number of years of the animal's life. This measurement applies to female breeding animals, with the assumption that all breeding females born in the farm are destined to milk production and will be sold only at the end of their useful life. Therefore, since birth until the beginning of milk production, the measure of each animal in each period only reports the feeding costs.

It is relevant to proceed with the implementation of the aforementioned formula. Since the price of cow's raw milk in euros/100 kg in Portugal suffered high variations in the last 9 years (Eurostat, 2014b), the inflation rate used for the calculation of the future price of milk is the average of inflation rates in Portugal over the last nine years, i.e. 2.23%. The milk price to be considered is the market price published by SIMA which in December 2011 was at €0.3217 per liter for the Portuguese market. We then proceeded with the extrapolation of milk price for the next 8 years based on the average inflation rate previously obtained.

The country-specific discount rate of 13.08% was used. This was the rate of government bonds to 10 years in December 2011, published in the Portuguese Central banks statistical series (Portuguese Central Bank, 2014).

In this research we will define 8 years as being the cow useful lifespan, the existence of 6 lactation periods, and 305 days as the average amount of days in production for each lactation period. These data are consistent with previous herds' valuation studies (Smith, 1973).

Contribution of feeding costs will comprise 56% of milk value (Neto, 2009). Daily female calves feeding cost was €1.16 and daily heifer calves feeding cost was €2. These figures were obtained through interview to the chartered accountant of Company A as referred previously, who also provided us the lactation production presented in table 4.

(Insert Table 4 here)

For the simulation we will not consider extraordinary factors. Consequently, factor *ef* is zero, once we do not possess enough information to assess the exceptional specificities of each animal. But in a dairy farm it is essential to consider this factor due

to its relevancy for the measure of the animal. In our case, it is also important, since we are measuring each animal individually.

We chose to calculate the animal updated net value annually so that the application of the formula would be more perceptible. To take due account of data on a monthly basis, we would apply the formula in months or in days and would then proceed with the discount rate adjustment.

Results from Table 5 show that the measurement of the animal resulting from our research is highly conditioned by the measures previously considered and described. The economic benefits expected in the sixth lactation period were higher than the fifth one; this is justified by the fact that in year *n* we incorporated the benefit of selling the animal for culling. Cull price was recorded at €400, based on the meat prices issued by SIMA.

(Insert Table 5 here)

Therefore, with the annual calculation of the animal present net value, we attain a more consistent measure. However, it should be pointed out that each farm should use its historic data when it comes to production and cost percentage averages. The reference values may distort reality, and market price is protected not only by milk price but also by the animal price at the time of its selling.

VI. CONCLUSION

The aim of this study was to assess the impact of the adoption of the Accounting and Financial Reporting Standard 17 (*Agriculture*) in the dairy sector, imposed by the new accounting frame of reference SNC, when it came into force on January 1st 2010.

To fully understand and debate the impact of this new accounting frame of reference, we must first perceive what changed within it and what importance those changes had. After reviewing prior literature, we prepared a case study, followed by a presentation and comparison of results. The main conclusion is that the impact of Accounting and Financial Reporting Standard 17 adoption in Portuguese dairy sector is inconclusive, since financial information from several dairy farms is not comparable. Fair value establishes a direct relationship between valuation and market prices; in Portugal, the measurement of bovine animals is established by SIMA and by animal traders, and dairy farms use quoted market prices in an active market to assess fair value, using

these two kinds of sources of information. However, the valuation criteria from the two sources are divergent, leading to inconsistent and non-comparable information. SIMA does not furnish information on all age ranges and lactation periods of dairy herds, creating a serious gap for those farms based on their market prices. Consequently, there is a clear ambiguity in the measurement of one of the assets which most contributes to the value of a dairy farm: the animals. Although Portuguese dairy farms are using quoted market prices to measure dairy herds, this sector evidences a disparate and unreliable market value of its companies.

Results also support the study conducted by Paananen and Lin (2009), who refer that IFRS adoption has made it harder for investors to take a decision. Azevedo (2005) observes that the adoption of fair value contributed for the rising of companies' profits, but in the dairy sector all depends on which fair value is attributed to biological assets. Like Aryanto (2011), we encountered distorted financial information, leading to decisions unfavorable to the real needs of dairy farms. Similarly to Chen *et al* (2013), it was noticed that fair value measurement is strongly influenced by prices' volatility, implying an extremely careful management and affecting the results obtained substantially.

Therefore, it would be urgent to achieve a model that would allow us to use the frame of reference in a consistent, real and reliable way. To solve the problems which were identified, we proceeded with the elaboration of a measurement model of dairy herds based on milk market price and present net value of future cash-flows. A formula was then prepared and tested to calculate the value of each animal; in our opinion, this is a possible method to measure bovines that are in a breeding stage. We were sustained by the principle of collection of useful accounting information for decision-making; if all stakeholders in the sector apply the same criterion, it will be possible to compare results and values of dairy farms. Comparability and reliability of financial information promoted by the application of this valuation model would lead to better assessment of dairy farms' business risk with the consequent impacts in the cost of debt contracted with finance institutions.

Despite the flexibility of the model, we are conscious that some adjustments might be needed in the formula so as to allow for its application in any dairy farm. This subject should be naturally further analyzed and improved. Future studies may ameliorate the model which was formulated or even create new models for other agriculture activities. We have no doubt that better results can only be attained with hard work and solid cooperation.

[1] The SIMA presents statistical and economic information on agro-food markets. It develops the necessary efforts related to collection and analysis of technical and economic data, either from national or regional level, on agro-food markets.

[2] According to SIMA, not all groups of animals are measured. For example, animals from six to eight months of age and from twelve months to breeding age are not contemplated. As for cows' measurement, we only have one measure for breeding cows, with no differentiation in lactation periods.

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Table 1 – Dairy farms and accounting recognition/measurement criteria

Accounting frame of reference	Recognition criteria	Measurement criteria
Portuguese Accounting Plan (POC)	Biological assets shall be recognized as property, plant and equipment assets.	Biological assets shall be measured at their acquisition or production costs, less any accumulated depreciated amounts.
Portuguese Accounting Standardization System (SNC)	An entity shall recognize a biological asset when and only when: a) The entity controls the asset as a result of past events. b) It is probable that future economic benefits associated with the asset will flow to the entity. c) The fair value or cost of the asset can be measured reliably.	A biological asset shall be measured on initial recognition and at the end of each reporting period at its fair value less costs to sell. A biological asset shall be measured at its cost less any accumulated depreciation and any accumulated impairment losses, only and only if the presumption that fair value can be measured reliably is rebutted on initial recognition
International Accounting Standards Board (IASB) Accounting Standards Board of Canada (AcSB) Australian Accounting Standards Board (AASB) New Zealand Accounting Standards Board (NZASB) South African Financial Reporting Standards Council (FRSC)	An entity shall recognize a biological asset when and only when: a) The entity controls the asset as a result of past events. b) It is probable that future economic benefits associated with the asset will flow to the entity. c) The fair value or cost of the asset can be measured reliably.	A biological asset shall be measured on initial recognition and at the end of each reporting period at its fair value less costs to sell. A biological asset shall be measured at its cost less any accumulated impairment losses, only and only if the presumption that fair value can be measured reliably is rebutted on initial recognition
Financial Accounting Standards Board (FASB)	Except for animals with short productive lives classified as inventory, all of the following shall be recognized as fixed assets: a) Breeding animals. b) All livestock (which includes cattle, hogs, sheep, and goats). c) Production animals.	All direct and indirect costs of developing animals shall be accumulated until the animals reach maturity and are transferred to a productive function. Fixed assets shall be depreciated over their useful lives.

Table 2: Measurement of biological assets by company.

	Animals classification bands:	Stock	Simulation 1	Simulation 2	Simulation 3	Simulation 4	Simulation 5	Simulation 6	Simulation 7	Simulation 8
Company A	A - Male calves until 1 month	21	1,050 €	6,300 €	2,625 €	2,100 €	2,100 €	3,150 €	2,100 €	3,150 €
	B - Female calves from 2 to 6 months	22	4,400 €	6,600 €	2,750 €	2,200 €	2,200 €	3,465 €	2,200 €	7,150 €
	C - Female calves from 7 to 12 months	3	1,200 €	900 €	1,200 €	1,200 €	750 €	1,050 €	750 €	1,380 €
	D - Heifer calves from 13 to 18 months	0	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
	E - Heifer calves from 19 to 24 months	0	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
	F - 1st lactation cows (25m-36m)	43	51,600 €	34,400 €	53,750 €	53,750 €	30,100 €	28,595 €	32,250 €	34,400 €
	G -2nd lactation cows (37m-48m)	46	55,200 €	36,800 €	57,500 €	57,500 €	32,200 €	30,590 €	34,500 €	36,800 €
	H- 3rd lactation cows (49m-60m)	41	41,000 €	32,800 €	51,250 €	51,250 €	28,700 €	27,265 €	28,700 €	32,800 €
	I - 4th lactation cows (61m-72m)	21	18,900 €	16,800 €	26,250 €	26,250 €	14,700 €	13,965 €	12,600 €	16,800 €
	J - 5th lactation cows (73m-84m)	19	11,400 €	15,200 €	23,750 €	23,750 €	13,300 €	12,635 €	9,500 €	15,200 €
	K - Remaining animals lactation (> 85)	16	9,600 €	12,800 €	20,000 €	20,000 €	9,600 €	10,640 €	5,600 €	12,800 €
	Total	232	194,350 €	162,600 €	239,075 €	238,000 €	133,650 €	131,355 €	128,200 €	160,480 €
	Variation			-16.34%	23.01%	22.46%	-31.23%	-32.41%	-34.04%	-17.43%
Company B	A - Male calves until 1 month	6	300 €	1,800 €	750 €	600 €	600 €	900 €	600 €	900 €
	B - Female calves from 2 to 6 months	15	3,000 €	4,500 €	1,875 €	1,500 €	1,500 €	2,362 €	1,500 €	4,875 €
	C - Female calves from 7 to 12 months	22	8,800 €	6,600 €	8,800 €	8,800 €	5,500 €	7,700 €	5,500 €	10,120 €
	D - Heifer calves from 13 to 18 months	14	12,600 €	8,400 €	14,000 €	14,000 €	4,900 €	9,310 €	4,900 €	7,000 €
	E - Heifer calves from 19 to 24 months	10	12,000 €	6,000 €	10,000 €	10,000 €	6,000 €	6,650 €	6,000 €	5,000 €
	F - 1st lactation cows (25m-36m)	25	30,000 €	20,000 €	31,250 €	31,250 €	17,500 €	16,625 €	18,750 €	20,000 €
	G -2nd lactation cows (37m-48m)	22	26,400 €	17,600 €	27,500 €	27,500 €	15,400 €	14,630 €	16,500 €	17,600 €
	H- 3rd lactation cows (49m-60m)	13	13,000 €	10,400 €	16,250 €	16,250 €	9,100 €	8,645 €	9,100 €	10,400 €
	I - 4th lactation cows (61m-72m)	11	9,900 €	8,800 €	13,750 €	13,750 €	7,700 €	7,315 €	6,600 €	8,800 €
	J - 5th lactation cows (73m-84m)	6	3,600 €	4,800 €	7,500 €	7,500 €	4,200 €	3,990 €	3,000 €	4,800 €
	K - Remaining animals lactation (> 85)	5	3,000 €	4,000 €	6,250 €	6,250 €	3,000 €	3,325 €	1,750 €	4,000 €
	Total	149	122,600 €	92,900 €	137,925 €	137,400 €	75,400 €	81,452 €	74,200 €	93,495 €
	Variation			-24.23%	12.50%	12.07%	-38.50%	-33.56%	-39.48%	-23.74%
Company C	A - Male calves until 1 month	7	350 €	2,100 €	875 €	700 €	700 €	1,050 €	700 €	1,050 €
	B - Female calves from 2 to 6 months	9	1,800 €	2,700 €	1,125 €	900 €	900 €	1,417 €	900 €	2,925 €
	C - Female calves from 7 to 12 months	1	400 €	300 €	400 €	400 €	250 €	350 €	250 €	460 €
	D - Heifer calves from 13 to 18 months	0	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
	E - Heifer calves from 19 to 24 months	0	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
	F - 1st lactation cows (25m-36m)	20	24,000 €	16,000 €	25,000 €	25,000 €	14,000 €	13,300 €	15,000 €	16,000 €
	G -2nd lactation cows (37m-48m)	34	40,800 €	27,200 €	42,500 €	42,500 €	23,800 €	22,610 €	25,500 €	27,200 €
	H- 3rd lactation cows (49m-60m)	29	29,000 €	23,200 €	36,250 €	36,250 €	20,300 €	19,285 €	20,300 €	23,200 €
	I - 4th lactation cows (61m-72m)	9	8,100 €	7,200 €	11,250 €	11,250 €	6,300 €	5,985 €	5,400 €	7,200 €
	J - 5th lactation cows (73m-84m)	3	1,800 €	2,400 €	3,750 €	3,750 €	2,100 €	1,995 €	1,500 €	2,400 €
	K - Remaining animals lactation (> 85)	1	600 €	800 €	1,250 €	1,250 €	600 €	665 €	350 €	800 €
	Total	113	106,850 €	81,900 €	122,400 €	122,000 €	68,950 €	66,657 €	69,900 €	81,235 €
	Variation			-23.35%	14.55%	14.18%	-35.47%	-37.62%	-34.58%	-23.97%
Company D	A - Male calves until 1 month	10	500 €	3,000 €	1,250 €	1,000 €	1,000 €	1,500 €	1,000 €	1,500 €
	B - Female calves from 2 to 6 months	32	6,400 €	9,600 €	4,000 €	3,200 €	3,200 €	5,040 €	3,200 €	10,400 €
	C - Female calves from 7 to 12 months	31	12,400 €	9,300 €	12,400 €	12,400 €	7,750 €	10,850 €	7,750 €	14,260 €
	D - Heifer calves from 13 to 18 months	22	19,800 €	13,200 €	22,000 €	22,000 €	7,700 €	14,630 €	7,700 €	11,000 €
	E - Heifer calves from 19 to 24 months	19	22,800 €	11,400 €	19,000 €	19,000 €	11,400 €	12,635 €	11,400 €	9,500 €
	F - 1st lactation cows (25m-36m)	37	44,400 €	29,600 €	46,250 €	46,250 €	25,900 €	24,605 €	27,750 €	29,600 €
	G -2nd lactation cows (37m-48m)	32	38,400 €	25,600 €	40,000 €	40,000 €	22,400 €	21,280 €	24,000 €	25,600 €
	H- 3rd lactation cows (49m-60m)	19	19,000 €	15,200 €	23,750 €	23,750 €	13,300 €	12,635 €	13,300 €	15,200 €
	I - 4th lactation cows (61m-72m)	19	17,100 €	15,200 €	23,750 €	23,750 €	13,300 €	12,635 €	11,400 €	15,200 €
	J - 5th lactation cows (73m-84m)	15	9,000 €	12,000 €	18,750 €	18,750 €	10,500 €	9,975 €	7,500 €	12,000 €
	K - Remaining animals lactation (> 85)	23	13,800 €	18,400 €	28,750 €	28,750 €	13,800 €	15,295 €	8,050 €	18,400 €
	Total	259	203,600 €	162,500 €	239,900 €	238,850 €	130,250 €	141,080 €	123,050 €	162,660 €
	Variation			-20.19%	17.83%	17.31%	-36.03%	-30.71%	-39.56%	-20.11%

Table 3: Net Income – different measurements.

Net income	Simulation 1	Simulation 2	Simulation 3	Simulation 4	Simulation 5	Simulation 6	Simulation 7	Simulation 8
Company A	8,049 €	-23,701	52,774 €	51,699 €	-52,651 €	-54,946 €	-58,101 €	-25,821 €
		-394%	556%	542%	-754%	-783%	-822%	-421%
Company B	-15,350 €	-45,050 €	-25 €	-550 €	-62,550 €	-56,497 €	-63,750 €	-44,455 €
		-193%	100%	96%	-307%	-268%	-315%	-190%
Company C	-53,344 €	-78,294 €	-37,794 €	-38,194 €	-91,244 €	-93,536 €	-90,294 €	-78,959 €
		-47%	29%	28%	-71%	-75%	-69%	-48%
Company D	94,639 €	53,539 €	130,939 €	129,889 €	21,289 €	32,119 €	14,089 €	53,699 €
		-43%	38%	37%	-78%	-66%	-85%	-43%

Table 4: Milk production for each lactation period.

1st lactation	2nd lactation	3rd lactation	4th lactation	5th lactation	6th lactation
29	32	35	34	33	30

Table 5: Present net value of the animals

Group	VAAL
Female calves	726 €
Heifer calves	904 €
1st lactation cows	1,200 €
2nd lactation cows	1,254 €
3rd lactation cows	1,301 €
4th lactation cows	1,329 €
5th lactation cows	1,390 €
6th lactation cows	1,578 €

Appendix 1. Valuation criteria

Valuation Criteria 1		Valuation Criteria 2		Valuation Criteria 3		Valuation Criteria 3	
Animals' age classification bands	**Price**	**Animals' age classification bands**	**Price**	**Animals' age classification bands**	**Price**	**Animals' age classification bands**	**Price**
Female calves until 1 month	50.00 €	Female calves until 1 year	300.00 €	Male/female calves until 6 months	125.00 €	Male/female calves until 3 months	100.00 €
Female calve from 2 to 6 months	200.00 €	Male calves until 1 year	250.00 €	Male/female calves from 6 to 12 montl	400.00 €	Male/female calves from 3 to 12 months	400.00 €
Female calves from 7 to 12 months	400.00 €	Heifer calves	600.00 €	Heifer calves/cows from 12 to 24 mont	1,000.00 €	Female calves from 12 months till heifer calves	1,000.00 €
Heifer calves from 13 to 18 months	900.00 €	Cows	800.00 €	Heifer calves/cows 24 months upward:	1,250.00 €	Cows	1,250.00 €
Heifer calves from 19 to 24 months	1,200.00 €						
1st lactation cows (25m-36m)	1,200.00 €						
2nd lactation cows (37m-48m)	1,200.00 €						
3rd lactation cows (49m-60m)	1,000.00 €						
4th lactation cows (61m-72m)	900.00 €						
5th lactation cows (73m-84m)	600.00 €						
remaining animals' lactation (> 85)	600.00 €						

Valuation Criteria 5		Valuation Criteria 6		Valuation Criteria 7		Valuation Criteria 8 (SIMA)	
Animals' age classification bands	**Price**	**Animals' age classification bands**	**Price**	**Animals' age classification bands**	**Price**	**Animals' age classification bands**	**Price**
Male/female calves until 6 months	100.00 €	Newborn*male calf*Turina*EUR/Unit	50.00 €	Female calves until 1 month	100.00 €	Newborn female calf	150.00 €
Male/female calves from 6 to 12 m	250.00 €	Newborn*female calf*Turina*EUR/Unit	150.00 €	Female calves from 2 to 6 months	100.00 €	Female calf until 3 months	180.00 €
Female calves from 12 to 18 month	350.00 €	3 to 6 months*female calf*Turina*EUR/Unit	157.50 €	Female calves from 7 to 12 months	250.00 €	Female calf from 3 to 6 months	325.00 €
Female calves from 18 to 24 month	600.00 €	8 to 12 months*heifer calf*Turina*EUR/Unit	350.00 €	Heifer calves from 13 to 18 months	350.00 €	Male/female calves from 8 to 12 months	460.00 €
Heifer calves 24 months upwards	700.00 €	Breeder*cow*Turina*EUR/Unit	665.00 €	Heifer calves from 19 to 24 months	600.00 €	Breeders	800.00 €
Cows	700.00 €			1st lactation cows (25m-36m)	750.00 €		
Cows 84 months upwards	600.00 €			2nd lactation cows (37m-48m)	750.00 €		
				3rd lactation cows (49m-60m)	700.00 €		
				4th lactation cows (61m-72m)	600.00 €		
				5th lactation cows (73m-84m)	500.00 €		
				remaining animals' lactation (> 85)	350.00 €		